REMARKS

Information Disclosure Statement

An Information Disclosure Statement is being submitted concurrently with this Amendment.

In addition, Applicants had previously submitted an Information Disclosure Statement dated September 6, 2001 containing references A (Hembree et al., US Patent No. 6,025,731) to S (Akram et al., US Patent No. 6,025,730). However, Applicants did not receive an initialed copy of Form 1449A/PTO indicating that the references cited in the Information Disclosure Statement had been considered. Accordingly, Applicants request an initialed copy of the above form.

Double Patenting Rejections

Claims 34-51 and 68-74 have been rejected under the judicially created doctrine of obviousness type double patenting over claims 1-23 of U.S. Patent No. 6,025,731 to Hembree.

These rejections are traversed. The present application is a division of parent case U.S. Patent No. 6,025,731 to Hembree (serial no. 08/821,468). The present method claims 34-51 and system claims 52-67 were originally filed with the parent case (serial no. 08/821,468). However, by the Office Action dated March 29, 1999 in the parent case (copy attached), claims 1-67 were subject to a Restriction Requirement. Method claims 34-51 were canceled from the parent case and refiled along with added claims 68-74 in the present divisional application. Under 35 USC §121 double patenting has been waived by the Patent Office. See also MPEP 804.01 on "Prohibition of Double Patenting Rejections Under 35 USC §121".

Although added claims 68-74 were not present in the parent case, claims 68-70 are "method" claims, and claims 71-74 are system claim. The Patent Office has held in the above cited Office Action that the interconnect claims of the issued parent case are patentably distinct from the method claims and the system claims. Accordingly the double patenting rejections of claims 68-74 over the interconnect claims of Hembree et al. '731 are also submitted to be improper.

The double patenting rejections are further traversed as being defective on their face. In this regard the Office Action states: "the claimed invention as taught by Hembree (US Patent No. 6,025,731) et al. and use the reference signal circuit to product a reference signal having a predetermined relation to the output frequency rather than

substantially the same frequency because both of these signals come from different stages, therefore the two signals will not be synchronized, in which only the reference signal acts as the clock source to flip-flop and triggers on the trailing edge respectively."

The above cited passage appears to be based on another case, as there is no disclosure in either Hembree et al. '731 or the present case on reference signals.

Claim Rejections Under 35 USC §102 and 35 USC §103

Claims 34-37 have been rejected under 35 USC §102(b) as being anticipated by Akram et al. ('741).

Claims 38-40 have been rejected under 35 USC §102(b) as being anticipated by Wood et al. ('179).

Claims 41-51 and 68-74 have been rejected under 35 USC §103(a) as being unpatentable over Wood et al. ('179) in view of Akram et al. ('779).

The rejections under 35 USC §102 and 35 USC §103 are traversed for the reasons to follow.

Summary of the Invention

Claims 34-51 and 68-74 are directed to a "method for fabricating an interconnect 10 (Figure 1) for a semiconductor die 22 (Figure 3) having a contact location 21 (Figure 3)". The interconnect 10 (Figure 1) is referred to in the specification as a "hybrid" because it includes both a rigid substrate 12 (Figure 3) with contact members 20 (Figure 3) for contacting the contact locations 21 on the die 22, and a flexible multi layered tape 14 (Figure 3) having conductors 18 (Figure 2) for conducting signals to and from the contact members 20. The rigid substrate 12 maintains the placement of the contact members 20 during testing, and in assemblies that include the interconnect 10. In addition, the rigid substrate 12 allows the contact members 20 to be accurately fabricated using semiconductor fabrication techniques, such as the etching process shown in Figures 5A-5C. Also, the contact members 20 can comprise materials such as silicon, ceramic, germanium and glass, having CTEs (coefficient of thermal expansion) that substantially match a CTE of the die 22. The multi layered tape 14 allows the conductors 18 to comprise low resistivity, relatively thick materials, such as copper foil. In addition, a conductive material 28 (Figure 4) between the contact members 20 and the conductors can comprise a resilient thermal expansion joint which allows the conductors 18 to expand and contract independently of the substrate 12.

In the embodiment illustrated in Figure 3A, a contact member 20A comprises a depression covered with a conductive layer 20A and a conductor 18A includes an opening 33 aligned with the contact member.

The fabrication method includes the steps of providing a substrate 12 (Figure 5A), and the step of forming a raised contact member 20 (Figure 5C) on the substrate 12 at least partially covered with a conductive layer 32 (Figure 5C) configured to electrically contact the contact location 21 (Figure 3).

The method also includes the step of "providing a separate polymer film 14 having a conductor 16 thereon". Admittedly raised contact members with conductive layers are known in the art. However, in the Akram et al. '741 a separate polymer film is not used to form conductors. Rather an etching or a deposition process is employed to form conductive traces 80-Figure 17 (column 8, lines 10-25). In Wood et al. '179 there is no suggestion of making circuit traces 27 (Figure 3) from a separate polymer film. In Akram et al. '779 there is no suggestion of making traces 44 (Figure 8) from a separate polymer film.

Independent claim 34 also recites the step of "forming a conductive material 28 (Figure 3) on the substrate separate from the conductive layer and the conductor in electrical communication with the conductive layer and the conductor and configured to provide an expansion joint between the contact member and the conductor". Independent method claims 38, 43, 68 include similar recitations on forming an "expansion joint". Independent system claim 68 also includes recitations on the expansion joint. The cited prior art does not suggest forming an expansion joint between a contact member and a conductor on a polymer film.

Independent method claim 38 also states that the tape includes "openings 26 (Figure 4) configured for placement on the contact members" and that the contact members are "projecting through the openings". Independent method claim 68 includes similar recitations. The cited prior art does not suggest fabrication of an interconnect with an opening and a projecting contact member.

Independent method claim 43 has been amended to recite a "conductive adhesive material" 28 (Figure 3) for the expansion joint. The cited prior does not suggest forming an expansion joint with a conductive adhesive material.

Independent method claim 48 is directed to a method for fabricating the interconnect with the depression contact member 20A of Figure 3A for electrically engaging a bumped die. Independent system claim 74 also has recitations directed to the depression contact member 20A. The cited prior art does not suggest a depression

contact member 20A (Figure 3A) with a separate conductor 18A having an opening 33 aligned with the contact member.

35 USC §102 Rejections Of Claims 34-37 Over Akram et al. '741

A proper 35 USC §102 rejection requires that a single reference disclose each and every element being claimed (See for example, Atlas Powder v. E.I. duPont, 750 F.2d 1569, 224 USPQ 409 (Fed. Cir. 1984)). However, Akram et al. '741 does not disclose the step of forming conductors using a separate polymer film, or the step of forming an expansion joint.

The Office Action cites column 3, lines 12-17 as teaching forming conductive traces equivalent to the present conductors. However, these conductive traces are etched or deposited (column 8, lines 10-25) rather than being on a separate polymer film as in the present claims.

Dependent claim 35 recites a further limitation of the conductor comprising a "copper foil laminated to the polymer film". In this regard, the Office Action has cited column 7, line 37 and lines 42-54 of Akram et al. as anticipating this feature. This interpretation is submitted to be incorrect, as the cited passage teaches a sintering process for forming metal silicide layer 78A (Figure 14).

Dependent claim 36 recites a further limitation of the "conductive material comprises a conductive adhesive material". In this regard, the Office Action has cited column 1, line 31 of Akram et al. as anticipating this feature. This interpretation is also submitted to be incorrect, as the cited passage teaches a bonding process for attaching dice to a substrate using an adhesive. The bonding process does not employ a conductive adhesive, and does not form an expansion joint between a contact member and a conductor as presently claimed.

Dependent claim 37 recites a further limitation of the "conductive material comprises a solder material". In this regard the Office Action has cited column 37, lines 34-44 of Akram et al. as anticipating this feature. This interpretation is also submitted to be incorrect, as the cited passage teaches a wire bonding process for attaching bond wires 82 (Figure 14) to the conductive traces 80. In addition, the soldered bond wires do not form an expansion joint between a contact member and a conductor as presently claimed.

In view of these fundamental differences, claims 34-37 are submitted to be both novel and unobvious over Akram et al. ('741).

35 USC §102(b) Rejections Of Claims 38-40 Over Wood et al. ('179)

As with Akram et al. '741, Wood et al. '179 also does not disclose the step of forming conductors using a separate polymer tape or the step of forming an expansion joint.

In support of the 35 USC §102 rejections, the Examiner has cited column 8, lines 6-8 of Wood et al. ('179) as teaching a tape. However, the tape described in the above cited passage is an electrically insulating (column 7, lines 67) adhesive tape (column 8, line 6) applied to a cover 21 (Figure 5A). It is not a tape containing conductors as presently claimed, and is not attached to a substrate for an interconnect as presently claimed. The Examiner has further cited the opening 92 (Figure 2) in Wood et al. ('179) as anticipating the present openings 26 (Figure 4) that are aligned with the contact members 20 (Figure 4). However, the opening 92 in Wood et al. ('179) is in the cover 73 (Figure 2), and functions to provide access for a vacuum device (column 8, lines 17-20). The opening 92 in Wood et al. ('179) thus has a different structure and function than openings in a polymer film aligned with contact members and containing a conductive material as presently claimed.

Further, Wood et al. ('179) discloses circuit traces 27 that connect directly to the bondpad contacts 31 (See Figure 4). As such, there is no conductive material in an opening configured to provide an expansion joint as presently claimed in independent claim 38. Also with respect to dependent claim 40, the conductive adhesive taught at column 3, lines 63-64 of Wood et al. ('179), is a connection to a die in a package or multi chip module, and is not an expansion joint between a conductor and a contact member as presently claimed.

In view of these fundamental differences, claims 38-40 are submitted to be both novel and unobvious over Wood et al. ('179).

35 USC §103(b) Rejections Of Claims 41-51 and 68-74 Over Wood et al. ('179) In View Of Akram et al. ('779)

MPEP 2142, 2143 set forth the three basic criteria for establishing a prima facie case of obviousness under 35 USC §103(a). First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success in obtaining the claimed invention based upon the references relied upon by the Examiner. Third, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

However, the combination of Wood et al. '179 and Akram et al. '779 does not teach all of the limitations of independent claims 34, 38, 43, 68 and 71, such that the third criteria of the above MPEP rule has not been met. In particular, as argued above, Wood et al. ('179) does not teach or suggest the limitations of an interconnect having a polymer tape with conductors, openings in the polymer tape aligned with contact members, and a conductive material or a conductive adhesive in the openings configured as expansion joints. With respect to Akram et al. ('741), this reference also does not teach or suggest the limitation of separate conductors on a polymer tape, and the limitation of expansion joints.

In addition, neither of these references teach the limitations of independent claims 48 and 74 of a separate conductor having an opening aligned with a depression contact member.

In view of these fundamental differences, claims 41-44, 47-51 and 68-74 are submitted to be unobvious over the cited combination of Wood et al. ('179) and Akram et al. ('741).

Conclusion

In view of the above arguments and amendments, favorable consideration and allowance of claims 34-44, 47-51 and 68-74 is requested. Should any issues remain, the Examiner is asked to contact the undersigned by telephone.

DATED this 14th day of May, 2002.

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May 14, 2002
Date of Signature

Stephen A. Gratton
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Marked Version Of Amended Claims Showing Changes

43. (thrice amended) A method for forming an interconnect for a semiconductor die having a contact location, comprising:

providing a substrate;

forming a contact member on the substrate comprising a base, a pillar and a projection configured to penetrate the contact location to a limited penetration depth;

providing a separate multi layered tape comprising a polymer film and a metal conductor on the film;

attaching the tape to the substrate with at least a portion of the conductor located proximate to the contact member; and

electrically connecting the contact member to the conductor by depositing a conductive adhesive material on the contact member and on the conductor configured to form an expansion joint therebetween.

44. (twice amended) The method of claim 43 wherein the conductor has an opening therein aligned with the contact member and the conductive adhesive material is deposited in the opening.